UDC 621.882.3-034.14/.15 : 539.4 : 620.17 DEUTSCHE NORM August 1983

Fasteners
Technical delivery conditions
Property classes for nuts
(previous classes)

DIN 267 Part 4

Mechanische Verbindungselemente; technische Lieferbedingungen; Festigkeitsklassen für Muttern; (bisherige Klassen)

This standard, together with DIN ISO 898 Part 2, March 1981 edition, DIN 267 Part 21, June 1981 edition, and Part 24, August 1983 edition supersedes October 1971 edition and DIN 267 Part 8, October 1971 edition which was withdrawn in 1981.

In keeping with current practice in standards published by the International Organization for Standardization (ISO), a comma has been used throughout as the decimal marker.

Property classes as defined in DIN ISO 898 Part 2 shall be used for new designs.

DIN 267 Part 4 was converted to the international property classes for nuts in 1967. The previous symbols 4D, 5D, 5S, 6G, 6S and 8G were replaced by code numbers 4, 5, 6, 8, 10, 12 and 14 where the code number indicated 1/100 of the minimum tensile strength of the bolt with which the nut could be mated and loaded up to the minimum tensile strength of the bolt, e.g. bolt 10.9 – nut 10. Appropriate proof load values were allocated to the nuts.

After relevant studies, experiments and calculations, this system of property classes was modified at the international level and laid down in International Standard ISO 898 Part 2 (see DIN ISO 898 Part 2) in an improved version and with greater certainty regarding tightening and the loadability of bolt/nut assemblies. Comprehensive explanatory notes are included in the National foreword and Appendix to DIN ISO 898 Part 2. This also explains that the previously usual hexagon nuts with the nominal 0,8 d nut height (e.g. nuts complying with DIN 934) cannot be fully loaded with sufficient assurance up to the yield point of the appropriate bolt or beyond this, without the nut being stripped. Higher proof load values have been allocated to the revised property classes in DIN ISO 898 Part 2, in order to ensure that fracture generally occurs in the case of overloading, in accordance with the usual principles of design.

It was originally intended to delete the previous specifications for property classes for nuts with coarse threads from DIN 267 Part 4, to replace these by a reference to DIN ISO 898 Part 2, and only to specify in DIN 267 Part 4 the property classes for nuts with fine threads which have not been specified at the international level. It was necessary to abandon this proposal, since not only higher proof load values are assigned to the ISO property classes, but these property classes also require larger nut heights in some cases (see DIN 970, for example). Therefore, in consideration of existing standards which cannot be superseded in the short term (e.g. DIN 934) and of numerous other documents and drawings, DIN 267 Part 4 was retained for an as yet unlimited period specifying the previous proof load values which are lower in comparison with DIN ISO 898 Part 2. However, because DIN ISO 898 Part 2 specifies the international code numbers, it has become necessary to add two vertical bars to the code numbers in DIN 267 Part 4, in order to differentiate products complying with the two standards, e.g. |8| instead of 8, so that there may be no confusion in the future.

By way of supplement to DIN ISO 898 Part 2, DIN 267 Part 23 lists the property classes (ISO classes) for nuts with fine threads, calculated on the basis of this standard. Furthermore, the property classes for nuts without defined proof load values (hardness classes) have been taken from DIN 267 Part 4 and have been specified in DIN 267 Part 24. Thus, at present, there are the following standards dealing with property classes for nuts:

DIN ISO 898 Part 2	Mechanical properties of fasteners; nuts with specified proof load values
DIN 267 Part 4	Fasteners; technical delivery conditions; property classes for nuts (previous classes)
DIN 267 Part 23	Fasteners; technical delivery conditions; property classes for nuts with fine threads (ISO classes)
DIN 267 Part 24	Fasteners; technical delivery conditions; property classes for nuts (hardness classes)

This division provides a clear separation between the previous DIN property classes and the new ISO classes. It permits a correspondingly similar separation in product standards and prevents incorrect allocation (see also the Explanatory notes).

Continued on pages 2 to 8

1 Field of application

This standard specifies the mechanical properties of nuts which have to withstand specified proof loads,

- with nominal thread diameters up to and including 39 mm;
- with ISO metric thread as defined in DIN 13 Part 13;
- with thread tolerances 6G and 4H to 7H in accordance with DIN 13 Part 15;
- with nominal heights not less than 0,8 D (including the normal countersink on the thread);
- with width across flats or external diameters not less than 1,45 D;

and of other nuts where reference is made to this standard.

This standard does not apply to nuts

- assigned to property classes in accordance with DIN ISO 898 Part 2 and DIN 267 Part 23 (ISO classes).

nor to nuts which have to meet particular requirements, for example with regard to

- locking ability (see DIN 267 Part 15);
- weldability;
- corrosion resistance (see DIN 267 Part 11);
- ability to withstand temperatures above + 300 °C or below − 50 °C (see DIN 267 Part 13).

Note 1. Nuts made from free-cutting steel shall not be used above + 250 °C.

Note 2. There is an increased risk of stripping for assemblies with threads having tolerances wider than 6g/6H.

The mechanical properties, and the test methods for these, for nuts with nominal thread diameters exceeding 39 mm shall be specified by agreement. The use of code numbers as defined in clause 2 is only permitted for these nuts where the nuts have all the mechanical properties assigned to these code numbers in accordance with clause 4 and are marked in accordance with clause 7.

This standard shall apply unamended for current documents in which reference is made to DIN 267 Part 4, e.g. non-standardized drawing details, unless it has been verified by calculation or experimentation that the higher proof load values specified in DIN ISO 898 Part 2 or DIN 267 Part 23 may be applied, and reference can accordingly be made to these standards.

2 Designation

Nuts shall be identified and marked with the property class to which they are assigned using a code number as given in table 1, where this number indicates 1/100 of the proof load stress, in N/mm², on a hardened test mandrel. This proof load stress is equal to the minimum tensile strength of a bolt which can be loaded up to this value when mated with the nut concerned.

Table 1. **Code numbers and symbols**

Code number for property class	4[1]	5	6	8	10	12
Proof load stress S_p N/mm²	400	500	600	800	1000	1200
Symbol for property class	|4|	|5|	|6|	|8|	|10|	|12|
1) Only for sizes above M 16.						

Nuts assigned to higher property classes can generally be used in the place of nuts assigned to lower property classes.

Nuts assigned to property classes 5 and 6 may be supplied made from free-cutting steel, if the letter symbol AU is added to the code number identifying the property class in the designation, e.g.:

Hexagon nut DIN 934 – M 10 – 6 AU

In a modification of the previous requirements in DIN 267 Part 4, October 1971 edition, in future, all nuts of property classes specified in this standard shall be marked by a vertical bar on either side of the code number, in consideration of the new property classes given in DIN ISO 898 Part 2 (ISO classes) to which higher proof load values have been allocated; see table 1 and clause 7.

3 Materials

3.1 Non-cutting working

The chemical composition specified in table 2 shall also apply to working by chip removal, where free-cutting steel is not being used.

Table 2. **Chemical composition**

Property class	Chemical composition, in % by mass (check analysis) [1]			
	C max.	Mn min.	P max.	S max.
4, **5** and **6**	0,50	–	0,110	0,150
8	0,58	0,30	0,060	0,150
10	0,58	0,30	0,048	0,058
12	0,58	0,45	0,048	0,058

1) Chips for the check analysis shall be taken uniformly over the whole cross section.

Thomas steel is not permitted for property classes 8, 10 and 12. "– 2" shall be added to the property class code number where Thomas steel shall not be used for manufacturing property classes 5 and 6 nuts.

Nuts assigned to property classes 8 (exceeding size M 16) and 10 shall be hardened and tempered if the proof load values as required in clause 5 cannot be attained in any other way. Hardening and tempering is necessary for all heattreated nuts (exceeding size M 16) with a nominal 0,8 d nut height (DIN 934) and for property class 10 nuts for applications at temperatures above + 250 °C. The values specified in DIN ISO 898 Part 2 shall apply as the hardness values for hardened and tempered nuts.

Nuts assigned to property class 12 shall be hardened and tempered.

If necessary, alloy steels shall be used for manufacturing property classes 10 and 12 nuts.

3.2 Machining from free-cutting steel

Table 3. **Chemical composition**

Property class	Chemical composition, in % by mass (check analysis) [1]			
	C max.	P max.	Pb max.	S max.
5 AU and **6 AU**	0,50	0,12	0,35	0,34

1) Chips for the check analysis shall be taken uniformly over the whole cross section.

Hexagon nuts in accordance with DIN 555, DIN 934 and slotted castle nuts in accordance with DIN 935 assigned to property classes 5 AU and 6 AU shall be specially marked as specified in clause 7, where they are made from free-cutting steel with the chemical composition given in table 3.

4 Mechanical properties

The properties listed in table 4 shall apply for testing at room temperature.

Table 4. **Mechanical properties**

Mechanical properties		Property class					
		4	**5**	**6**	**8**	**10**	**12**
Proof load stress S_p	N/mm²	400	500	600	800	1000	1200
Vickers hardness HV 5	max.	302	302	302	302	353	353
Brinell hardness HB 30	max.	290	290	290	290	335	335
Rockwell hardness HRC	max.	30	30	30	30	36	36
Widening		See subclause 6.4.					

Conversion of the Vickers and Brinell hardness values into Rockwell hardness values as specified in DIN 50 150.

5 Proof load values

The proof load values are calculated from the proof load stress S_p multiplied by the nominal stress area A_S of the appropriate bolt threads.

Nuts with proof load values exceeding 350 000 N (values beneath the stepped line) may be exempted from proof load testing. A minimum hardness for these nuts shall be agreed between manufacturer and customer.

Table 5. **Proof load values for nuts with coarse thread complying with standards in the DIN 13 series**

Thread size	Bolt nominal stress area A_S mm²	Property class					
		4	5	6	8	10	12
		Proof load ($A_S \times S_p$), in N					
M 3	5,03	–	2 500	3 000	4 000	5 000	6 000
M 3,5	6,78	–	3 400	4 050	5 400	6 800	8 150
M 4	8,78	–	4 400	5 250	7 000	8 750	10 500
M 5	14,2	–	7 100	8 500	11 400	14 200	17 000
M 6	20,1	–	10 000	12 000	16 000	20 000	24 000
M 7	28,9	–	14 500	17 300	23 000	29 000	34 700
M 8	36,6	–	18 300	22 000	29 000	36 500	43 000
M 10	58	–	29 000	35 000	46 000	58 000	69 500
M 12	84,3	–	42 100	50 500	67 000	84 000	100 000
M 14	115	–	57 500	69 000	92 000	115 000	138 000
M 16	157	–	78 500	94 000	126 000	157 000	188 000
M 18	192	76 800	96 000	115 000	154 000	192 000	230 000
M 20	245	98 000	122 000	147 000	196 000	245 000	294 000
M 22	303	121 000	151 000	182 000	242 000	303 000	364 000
M 24	353	141 000	176 000	212 000	282 000	353 000	423 000
M 27	459	184 000	230 000	276 000	367 000	459 000	550 000
M 30	561	224 000	280 000	336 000	448 000	561 000	673 000
M 33	694	277 000	347 000	416 000	555 000	694 000	833 000
M 36	817	327 000	408 000	490 000	653 000	817 000	980 000
M 39	976	390 000	488 000	585 000	780 000	976 000	1 170 000

Table 6. **Proof load values for nuts with fine thread complying with standards in the DIN 13 series**

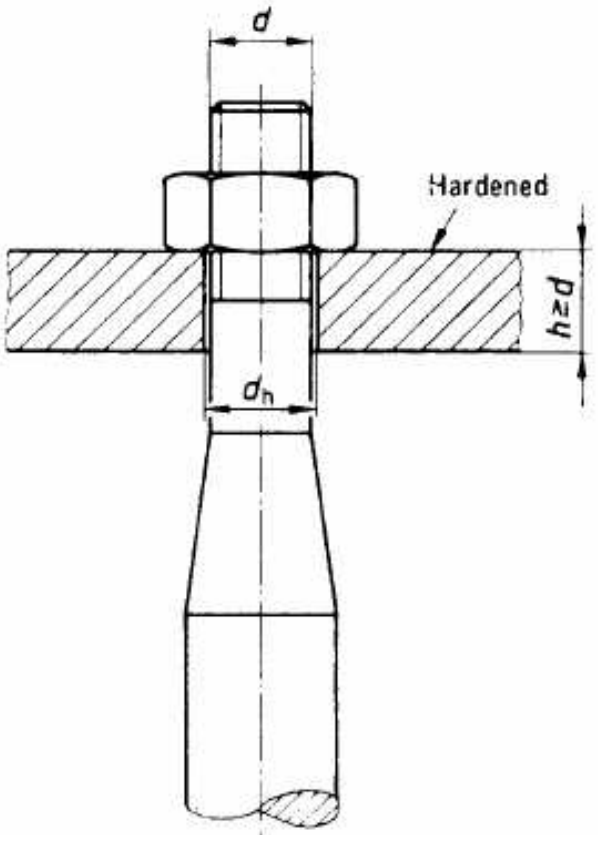
Thread size	Bolt nominal stress area A_S mm²	Property class				
		5	6	8	10	12
		Proof load ($A_S \times S_p$), in N				
M 8 × 1	39,2	19 600	23 500	31 000	39 000	47 000
M 10 × 1	64,5	32 200	38 700	51 500	64 500	77 500
M 10 × 1,25	61,2	30 600	37 000	49 000	61 000	73 500
M 12 × 1,25	92,1	46 000	55 000	74 000	92 000	110 000
M 12 × 1,5	88,1	44 000	53 000	70 000	88 000	106 000
M 14 × 1,5	125	62 200	75 000	100 000	125 000	150 000
M 16 × 1,5	167	83 500	100 000	134 000	167 000	200 000
M 18 × 1,5	216	108 000	129 000	173 000	216 000	259 000
M 18 × 2	204	102 000	122 000	163 000	204 000	245 000
M 20 × 1,5	272	136 000	163 000	218 000	272 000	326 000
M 20 × 2	258	129 000	155 000	206 000	258 000	310 000
M 22 × 1,5	333	166 000	200 000	266 000	333 000	400 000
M 22 × 2	318	159 000	191 000	254 000	318 000	382 000
M 24 × 2	384	192 000	230 000	307 000	384 000	460 000
M 27 × 2	496	248 000	298 000	397 000	496 000	595 000
M 30 × 2	621	310 000	373 000	497 000	621 000	745 000
M 33 × 2	761	380 000	456 000	608 000	761 000	914 000
M 36 × 3	865	432 000	519 000	692 000	865 000	1 040 000
M 39 × 3	1030	501 000	618 000	825 000	1 030 000	1 240 000

6 Testing

6.1 Proof load test

The proof load test shall be used wherever the capacity of testing equipment permits. The test shall be the referee method in cases of doubt.

The nut shall be assembled on a hardened and threaded test mandrel as shown in figure 1 or figure 2. The tensile test illustrated in figure 1 shall be determinant in cases of doubt.



$d_h = d^{D11}$

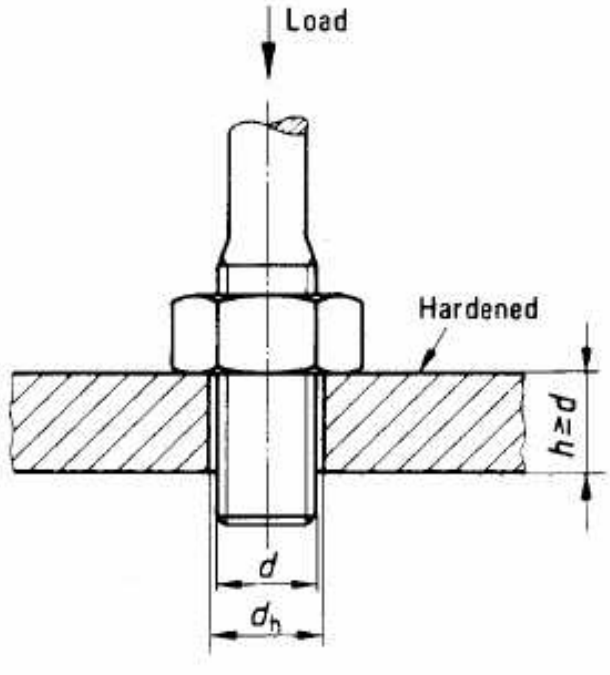


Figure 2. Axial compressive load test

The proof load shall be applied against the nut in an axial direction and shall be sustained for 15 seconds. The nuts shall resist the load without failure by stripping or fracture, and shall be movable by hand on the mandrel after the load is released. Use of a spanner up to one half turn to start the motion is permitted.

If the thread of the mandrel is damaged during the test, the test shall be invalidated.

The hardness of the test mandrel shall be at least 45 HRC.

The thread on the mandrel shall be within tolerance class 5h except for the major diameter, which shall be within the last quarter of the 6g range.

6.2 Hardness test

For routine inspection, hardness can be measured on one bearing surface of the nut. The hardness shall be taken as the mean of three values obtained when measuring at three locations spaced 120° apart. In cases of doubt, the hardness tests shall be carried out on a longitudinal section through the nut axis and with impressions placed as close as possible to the major diameter of the nut thread.

The Vickers hardness (HV 30) test shall be the referee test, where possible.

If hardness is tested using the Brinell or Rockwell hardness scales, the conversion tables in accordance with DIN 50 150 shall be used.

The Vickers hardness test shall be carried out as specified in DIN 50 133 Part 1.

The Brinell hardness test shall be carried out as specified in DIN 50 351.

The Rockwell hardness test shall be carried out as specified in DIN 50 103 Part 1.

6.3 Surface integrity test

DIN 267 Part 20 shall apply for the surface integrity test.

6.4 Widening test

DIN 267 Part 21 shall apply for the widening test.

7 Marking

7.1 Symbols

Table 7.

Property class	Code number	4	5	6	8	10	12
	Symbol	4	5	6	8	10	12

A groove shall additionally be cut as a symbol in one face of free-cutting steel nuts (dealt with in subclause 3.2) complying with DIN 555, DIN 934 and DIN 935 (see figure 3).

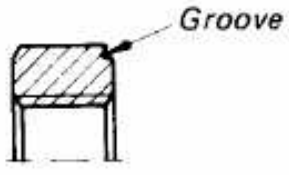


Figure 3.

7.2 Identification

Hexagon nuts of nominal thread diameters not less than 5 mm shall be marked with the symbol identifying its property class as listed in subclause 7.1 on the bearing surface or side (see figures 4 and 5). Embossed marks shall not protrude beyond the bearing surface of the nut.

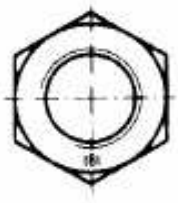


Figure 4.

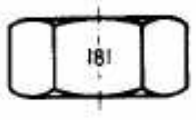


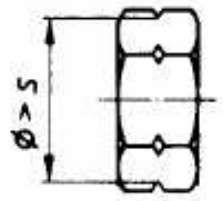
Figure 5.

7.3 Marking of left-hand threaded nuts

Nuts with left-hand thread shall be marked by indenting on one bearing surface of the nut as illustrated in figure 6.

The alternative marking method as illustrated in figure 7 may also be used.

Figure 6. Left-hand thread marking



s = width across flats

Figure 7. Alternative left-hand thread marking (groove on the points of the hexagon half-way up the nut height)

7.4 Trade (identification) marking

The trade (identification) marking of the manufacturer is mandatory on all nuts covered by the obligatory marking requirements for property classes, provided technical reasons do not preclude this.

Packages, however, shall be marked in any case.

Standards referred to

Standards in the DIN 13 series

DIN	13 Part 13	ISO metric screw threads; selected sizes for screws, bolts and nuts from 1 to 52 mm screw thread diameter and limits of sizes
DIN	13 Part 15	ISO metric screw threads; fundamental deviations and tolerances for screw threads from 1 mm diameter
DIN	267 Part 4	(October 1971 edition) Bolts and screws, nuts and similar threaded components; technical delivery conditions, property classes and methods of test for carbon steel or low alloy steel nuts (withdrawn in 1983)
DIN	267 Part 11	Fasteners; technical delivery conditions, with addenda to ISO 3506; corrosion-resistant stainless steel components
DIN	267 Part 13	Fasteners; technical delivery conditions, components for bolted connections made mainly from materials with high impact strength at high and low temperatures
DIN	267 Part 15	Fasteners; technical delivery conditions; prevailing torque type nuts
DIN	267 Part 20	Fasteners; technical delivery conditions; surface irregularities on nuts
DIN	267 Part 21	Fasteners; technical delivery conditions; widening test on nuts
DIN	267 Part 23	Fasteners; technical delivery conditions; property classes for nuts with fine thread (ISO classes)
DIN	555	Hexagon nuts; M 5 to M 100 × 6 threads, product grade C
DIN	934	Metric hexagon nuts; product grades A and B
DIN	935	Hexagon slotted castle nuts
DIN 50 103	Part 1	Testing of metallic materials; Rockwell hardness test, scales C, A, B, F
DIN 50 133	Part 1	Testing of metallic materials; Vickers hardness test, proof load range 49 to 980 N (5 to 100 kp)
DIN 50 150		Testing of steel and cast steel; conversion tables for Vickers hardness, Brinell hardness, Rockwell hardness and tensile strength
DIN 50 351		Testing of metallic materials; Brinell hardness test
DIN ISO 898	Part 2	Mechanical properties of fasteners; nuts with specified proof load values

Amendments

The following amendments and additions have been made in comparison with the October 1971 edition, and with DIN 267 Part 8, October 1971 edition which was withdrawn in January 1981:

a) the two standards have been combined and aligned with DIN ISO 898 Part 2;

b) the marking of the property classes has been supplemented;

c) property classes to which low proof load values were allocated have been replaced by a reference to DIN ISO 898 Part 2;

d) property classes with no specified proof load values (hardness classes) have been deleted and included in DIN 267 Part 24;

e) property class 4 (for sizes above M16) has been included;

f) minimum hardnesses have been specified for hardened and tempered nuts.

Explanatory notes

The original intention was to replace DIN 267 Part 4 by DIN ISO 898 Part 2 to such an extent that the specifications still in use will only apply to nuts with fine thread which are not yet covered by the ISO Standard. However, this proposal could not be put into practice because it was not possible to abandon the previous hexagon nuts with 0,8 *d* heights (e.g. nuts complying with DIN 934) generally and in the short term in favour of higher nuts with greater proof load values, and because the property classes as defined in DIN 267 Part 4 are referred to in numerous documents, e.g. drawings. A draft of DIN 267 Part 4 published in June 1981 was criticized accordingly; this led to a revision of policy. The question of property classes for nuts with fine threads was included in this revision, an accordance with work being undertaken at the international level.

A clear distinction has been introduced between the previous and new (modified) property classes and the corresponding products on the basis of DIN ISO 898 Part 2, taking DIN 267 Part 4 (October 1971 edition) into consideration.

The following solution has been chosen with regard to the property classes of nuts:

DIN ISO 898 Part 2* Mechanical properties of fasteners; nuts with specified proof load values

The March 1981 edition of DIN ISO 898 Part 2 remains valid without amendment. It specifies the new property classes for nuts with full and reduced loadability and with the higher proof load values agreed internationally.

These are property classes

4, 5, 6, 8, 10, 12
for nuts with full loadability, and
04, 05 (previously 06)
for nuts with reduced loadability.

The property classes for nuts with full loadability shall apply in the first place only to the nuts known as ISO nuts with coarse thread and to nuts where express reference is made to DIN ISO 898 Part 2.

DIN 267 Part 4 Fasteners; technical delivery conditions, property classes for nuts (previous classes)

The classes specified in the October 1971 edition of DIN 267 Part 4 remain fundamentally unamended; however, the field of application has been restricted taking DIN ISO 898 Part 2 into account (see foreword).

DIN 267 Part 23 Fasteners; technical delivery conditions, property classes for nuts with fine thread (ISO classes)

This standard specifies property classes for nuts with fine thread and the principle applied in DIN ISO 898 Part 2 for nuts with coarse thread is used as a basis for the property classes (proof load values), i.e. nut blanks for nuts with fine thread have the hardness and heat treatment specified for nuts with coarse thread, assigned to the next higher property class.

DIN 267 Part 23 applies only to ISO nuts (see DIN 971 Part 1 and Part 2 (at present both at the stage of draft)) and to other nuts with fine thread where reference is made to DIN 267 Part 23. It is intended to review this standard and replace it if necessary when the relevant international specifications supplementing ISO 898 Part 2 become available

DIN 267 Part 24 Fasteners; technical delivery conditions, property classes for nuts (hardness classes)

This standard lists property classes (hardness classes) for nuts for which no loading values can be specified because of their form and dimensions, but which may only be classified according to their hardness and are marked accordingly.

Symbol	11H	14H	17H	22H
Minimum Vickers hardness	110	140	170	220

Property classes (hardness classes) as defined in DIN 267 Part 24 have not previously been considered for nuts at the international level. At the national level, however, these property classes were considered desirable. Thus, the standard has no international basis.

International Patent Classification

G 01 L 5-24